

4.—*The South African Hirudinea*—Part I.—By E. J.
GODDARD, B.A., D.Sc., and D. E. MALAN, B.A.

THE present paper deals with some members of the Hirudinea collected in the Orange River Colony and Cape Colony.

Comparatively little is known of the South African representatives of the group, and the few which have been described are imperfectly known. The name of one of the described forms appears to be erroneously applied to any *Hirudo* found in the South African Union.

The first mention of the South African forms in scientific literature appears to be in the accounts of the results of the *Novara* Expedition which visited these parts in 1868. In this Grube has described two species of *Hirudo*—*H. septemstriata* and *H. capensis*.

In 1871 Grube described a form from Port Natal under the name *Aulacostomum Kraussii*.

Blanchard in 1898 described forms from German East Africa under the following names:—

Glossiphonia Stuhlmanni (sp. nov.).

Helobdella tricarinata (gen. et sp. nov.).

Hirudo Hildebrandti (sp. nov.).

Salifa perspicox (gen. et sp. nov.).

Beyond these accounts we know of no others referring to Hirudinea in the region including the above-mentioned areas and the intervening country. Up to the present time, as the result of a short period of collecting we have succeeded in finding representatives of Ichthyobdellidæ, Glossiphoniidæ, and Gnathobdellidæ; and as Blanchard has described one representative of the Herpobdellidæ, viz., *Salifa*, we now know that the Hirudinea are represented in the southern half of the continent by members of all the divisions of the group. This was to be expected, as all continental areas have supplied representatives of each of the divisions.

However, we have not yet found any terrestrial forms, or rather, land leeches, but this is readily explicable, since the country so far

investigated is by no means suited to the existence of such. It is, nevertheless, highly probable that such forms will eventually be found in the moister and well-wooded parts of the Union, or more especially in the more tropical country north of the same. Such forms, if obtained, should in all probability possess a special interest as indicated by one of us (E. J. G.) in the *Proc. Linn. Soc. of N.S.W.*, 1910.

In this paper we restrict attention to representatives of the Glossiphoniidæ and Gnathobdellidæ.

The types of the species described are preserved in the South African Museum.

I. GLOSSIPHONIIDÆ.

We know of no previous record of any representatives of this group south of German East Africa.

The occurrence of *Placobdella* sp. calls for no special remarks, since at the most it cannot have any more than mere specific importance, and as we have only a single and poorly preserved specimen for examination we can do little more than record the genus for these parts, and note any characters which we deem reliable in a preserved specimen. The absence of the genus from South Africa would give more ground for surprise than does its occurrence. It is perhaps not out of place to remark here that, although like so many other fresh water groups of animals, the fresh water Hirudinea enjoy a wide distribution (most parts of the earth possessing characteristic species), yet, at least in the main fresh water group, Glossiphoniidæ, this distribution cannot be rashly attributed to the same ready means of dispersal as serve to explain the distribution of other fresh water groups. This is supported not only by the occurrence of definite characteristic species in most large areas, but also by the facts that the eggs are carried in most Glossiphoniidæ attached to the ventral surface, and experiments indicate that they cannot withstand the effects of sea water or desiccation. This may be taken to indicate that their dispersal has been carried out over short distances and that their present universal distribution must signify vast changes in geography in the past. In other words their distribution seems to prove that the family is an ancient one. This is strengthened by the simple nature of the somite, the comparatively well-preserved cœlorne, &c.

For the second representative of the group described in this paper we institute a new generic name, *Marsupiobdella*.

Whereas in other Glossiphoniidæ the young attached to the ventral surface are protected in a temporary "marsupium" formed by the inflection of the lateral margins of the body, we find in this new genus that the greater portion of the much thickened trunk region is occupied by a large internal brood pouch, which displaces the tissues of the body and has reduced the same to a remarkable extent. This pouch opens to the exterior through a longitudinally elongate aperture situated behind the centre of the ventral surface. We may remark here preliminarily that this is the most extreme and peculiar morphological development in the Glossiphoniidæ.

In this case dispersal over long distances is practically impossible, since the accidental dropping of eggs from the ventral surface, which might possibly happen in other forms, cannot take place in *Marsupiobdella*.

MARSUPIOBDELLA gen. nov.

Glossiphoniidæ of small size; sensory annulus occupying the middle region of the triannulate somite.

Male genital pore opening to exterior between somites xi, xii, and between post-oral annuli 21, 22.

Female genital pore originally situated between annuli 2, 3 of somite xii, but functionless in adult.

Trunk portion of body greatly thickened, and containing a large brood pouch which opens to the exterior on the ventral surface through an elongate aperture.

Somites v-xxvi triannulate; xxvii biannulate. Eyes two.

MARSUPIOBDELLA AFRICANA gen. et sp. nov.

This interesting form was obtained in some abundance from the surface of a fresh water crab by Dr. Purcell at Backen's River, C.C.

The specimens, which were preserved in spirit for some years, show no pattern and have a homogeneous greenish-grey colour, except that the head region and the posterior sucker have an opaque white appearance. The head region shows an annulation which is so faint and indistinct that it has been neglected in making a count of the annuli on the dorsal surface. On the ventral surface the two annuli immediately behind the anterior sucker have the same white colouration, and are regarded as indicating the posterior limits of the head region. The furrow separating these two annuli is indicated on the dorsal surface of the head, and although distinct it is so faint in comparison with the succeeding grooves separating

the post-cephalic annuli that it is deemed better in referring to structures on the dorsal surface to do so in terms of post-cephalic annuli. The head region is marked off from the succeeding annulus by a deep constriction.

Behind the head the body may be divided into a narrow "neck" region, which increases in width gradually and extends as far as the 21st post-oral annulus, and into a much thickened trunk region which in many individuals bulges anteriorly on the ventral aspect. Viewed dorsally the body in general is fusiform. The appearance of this trunk region appears to depend on the condition of the young forms and developmental stages contained in the brood pouch.

The dimensions of several individuals are given in a table below :—

	A	B	C
Greatest length	3.90 mm.	3.71 mm.	3.52 mm
Greatest breadth	1.57	1.50	1.28
Diameter of oral sucker45 × .45	.42 × .44	.32 × .41
Diameter of posterior sucker58	.58	.51
Breadth of neck behind posterior sucker.....	.54	.52	.51

Behind the male genital aperture there is a gradual increase of the body in depth, so that this is taken to lie on the posterior region of the neck. This is well seen in a longitudinal section, in which also a noticeable feature is the discontinuity of the longitudinal muscle fibres in the dorsal median line through three or four annuli which correspond in position to the transitional annuli of the posterior portion of the neck and the anterior portion of the trunk on the ventral aspect.

The total number of post-cephalic annuli on the dorsal side is 66, and on the ventral aspect are 64 annuli. Since the two anterior annuli of the ventral surface belong to the head region we have four less annuli on the ventral than on the dorsal. Behind the thirty-third (33rd) annulus of the ventral side the annuli, with the exception of the nineteen in front of the posterior sucker are difficult to make out; much more so in sections than in entire specimens. This indistinctness is due to the tension of the skin as the result of the capaciously developed brood pouch. In the centre of this area is a very peculiar longitudinally elongate slit with prominent lips. The annuli related to it are modified, including annuli 33-44. Annuli 36-43 converge towards each side of the pore, in such fashion that the middle elements of this group only run throughout in a strictly transverse direction, those anterior to these as they pass

towards the aperture curving backwards, and those posterior curving forwards. Further, the furrow separating annuli 35, 36 is not continuous, so that the thirty-fifth (35th) annulus sweeps back mesially to form the anterior border of the pore. Similarly the furrow separating annuli 43, 44 is incomplete, and annulus 44 is continued forwards mesially to form the posterior margin of the aperture. That separating the thirty-fourth and thirty-fifth, although continuous, is somewhat drawn backwards in the middle line.

Sensory papillæ are present on all the annuli, but are very difficult to make out in the middle portion of the body. In the posterior part of the dorsal surface it is seen that they are more prominent on every third annulus, so that the triannulate nature of the somite is definitely made out. That the sensory annulus of the triannulate somite is the middle ring, as in most Glossiphoniidæ with a similarly constituted somite is concluded on the following grounds: (1) The thirtieth and every succeeding third annulus as far back as the sixty-third are sensory (we refer to post-cephalic annuli). (2) The genital apertures, although not visible on an external examination, were readily made out in longitudinal sections. The male pore was found to lie between the twenty-first and twenty-second post-oral annuli. Between the twenty-third and twenty-fourth annuli is situated the remains of the female genital pore, as indicated by the definitely prolonged furrow in the median line extending towards, but not meeting, the female duct, which no longer opens to the exterior directly but into the brood pouch. The genital apertures in their original condition are separated then by two annuli. In all Glossiphoniidæ, without exception, whenever the pores are separated by two annuli the male lies between somites xi and xii, and the female between annuli 2 and 3 of somite xii. Since this is supported so strongly phylogenetically we can safely conclude that the same holds in this case.

This indicates then that the twenty-first post-oral annulus is the last annulus of somite xi; in other words the twentieth post-oral annulus, which is really the eighteenth post-cephalic annulus, is sensory. This fits in with the fact that the thirtieth post-cephalic, and each succeeding third annulus, is sensory and the middle annulus of its somite. We can then denote the somitic constitution of the genus as follows:—

- Somites i-v = Head + first post-cephalic annulus.
- Somites vi-xxvi = post-cephalic annuli 2-64.
- Somite xxvii = post-cephalic annuli 65-66,

Somites v-xxvi are then triannulate, somite xxvii biannulate, but nothing can be said in regard to somites i-iv, except that the annulation is very indistinct or absent. It is interesting to note that somite v, which is triannulate ventrally, shows a much more indistinct furrow between annuli 1, 2 than between 2, 3; further it is biannulate dorsally and the anterior annulus is decidedly broader than the posterior. These facts bear out the idea that the order of origin of the annuli is, as in the majority of Glossiphoniidæ.

1, 2, 3 (annuli)

c a b (order of origin).

In a number of the individuals examined the brood pouch aperture was a very prominent structure. At first it was supposed that it was an abnormally developed genital aperture, and it so happened that one specimen had a minute structure protruding through the aperture. The fact that no genital aperture other than this could be made out on an external examination supported this idea, and suggested that the protruding structure was a penis. The posterior position of such a genital aperture, and the presence of penis in an undoubted Glossiphonid, were so unique that it was found necessary at this stage to section an individual. It was then found that in several individuals which were sectioned, the pore led into a large pouch which extended through six somites, and in this were found, in different individuals, young in all stages of development. One such individual contained segmentation stages only, and although the position of the pore or slit is very definitely indicated, no communication to the exterior was found. Several other specimens examined externally showed no definite aperture, although the position of such if it did exist was clearly indicated. It seems then that the absence of such in some specimens is due not to its being obscured by contraction, but by the fact that the aperture exists only when the contained young are well advanced. The supposed "penis" mentioned above was found to be a young individual protruding through the aperture. It has been stated already that the female ducts no longer open directly to the exterior, but into the brood pouch; so that the ova would pass directly into this chamber. Hypodermic impregnation which we now take place in some Glossiphoniidæ, and probably in all, as previously suggested by one of us (E. J. G.), would seem to be necessary here owing to the absence of a female pore opening to the exterior. This is strongly supported by the remarkable tenuity of the body wall in the brood

pouch region, and the fact that sections reveal loose packets of spermatozoa in this region. Otherwise it must be suggested that spermatozoa are obtained from the individual itself, which is certainly not the case, as the male ducts have direct communication with the exterior, well-developed muscular terminal portions, and further in the specimens sectioned were found to have an abundance of mature spermatozoa in the terminal portions, thus indicating that spermatozoa pass to the exterior.

Although anatomical details of this form will be published at a later date, it may not be out of place to remark here on the character of the brood pouch. Since *Glossiphonia* carries its eggs and young attached to the ventral surface, and protected in an external pouch or "marsupium," formed by the curvature or inflection of the thin lateral margins of the body, it might reasonably be suggested that the brood pouch in this new form was the result of the concrescence of such inflected margins. Sections indisputably show that such is not the case. It is found, for instance, that the nerve cord retains its ventral position as far as the brood pouch, and then is directed upwards to the dorsal side to pass over the hump of the brood sac, afterwards descending on the posterior side of this sac to the ventral surface. The dorsal body wall in the region of the sac is most markedly attenuated. Again this region of the body which, were the marsupium or brood pouch so derived, would possess typical dorsal and ventral musculature, possesses only the dorsal set. Similarly the ventral floor of the brood sac, instead of being provided with both dorsal and ventral musculatures possesses only a ventral set. This seems to indicate that the pouch has been formed as an excavation in the substance of the ventral portion of the body, or as a modification of part of the ventral sinus. Supporting the latter of these suggestions is the fact that the ovary is a very short structure more or less spherical in form, and not of the elongate sac-like character as found in other *Glossiphoniidæ*.

II. GNATHOBDELLIDÆ.

Numerous members of the *Hirudinidæ* have been obtained which show that there occur a large number of varieties or species bridging the differences between *H. semptemstriata* and *H. capensis*. Unfortunately no specimens of the latter species have been accessible. Although all the species including the above-mentioned forms have

been placed in the genus *Hirudo*, we regard this as a tentative step, since the differences between such structures as the jaws and those of *Hirudo* (in its restricted sense) are very great. However, we deem it better to leave them in this genus until anatomical details have been made out.

One interesting feature about most of the specimens dealt with is that the annuli are arranged in groups between which the furrows are much more pronounced. This grouping of the annuli corresponds not only with the metameres, but also with order of origin of the annuli.

GEN. *HIRUDO*, Lin.

Syst. nat. 10th Ed., 1758.

HIRUDO SEPTEMSTRIATA Grube.

Two specimens of this species were obtained from Rosmead and three from Richmond, C.C.

All the specimens are small, and no doubt represent young individuals, but are interesting as corroborating Grube's account of the occurrence of the species in South Africa. This seems to us very important since the species occupies an important position in the series comprising the various species noted in this paper together with *H. capensis* Grube and *H. Hildebrandti* Blanchard.

There seems no necessity to alter the main portion of Grube's definition of the species, namely, that referring to the coloration beyond instituting in place of "ventre concolore," "ventre concolore autem paulo pallidiore."

The most marked distinction between this and any of the other species is the absence of the marginal yellow band of the dorsal surface. Grube states, "Am Cap von einem Apotheker erhalten, vielleicht aus Ostindien stammend." With this we disagree, since the relationship of this form to the other species indicates that it is an endemic form, or at least we maintain that it has been established in South Africa too long to justify such a conclusion.

Grube figures an obscure band on either side of the median line in the middle and posterior region of the body, but we have been unable to note the existence of such in any of our specimens. Except in the case of the median band there is great difficulty in making out the pigment areas in our preserved specimens, and this may account for the apparent absence of such. At the same time we cannot make out the white bands figured by Grube on the dorsal surface of the posterior sucker. Perhaps we have in this good reasons for instituting a new species.

HIRUDO MORRISII sp. nov.

Locality.—Wit River, Bain's Kloof, Wellington.

Diagnosis.—Body flattened and elongate in living condition.

Dorsal surface greenish brown with seven dark bands continuous along the length of the body, the outermost on each side broader than the others.

Papillæ not very distinct in living condition, two in each of outermost dark bands, one in dark band within this, and a fourth to the outer side of the median dark band.

Ventral surface slate colour, the ventral surfaces of anterior and posterior suckers much lighter.

Outermost limits of dorsal surface, where it meets ventral surface ornamented with a prominent yellow band.

Two specimens of this species were obtained and kept alive for some time. The specimens eventually died in an expanded condition, but appear to have a much greater body depth than when alive.

Greatest length	46	mm.
„ breadth	4.5	„
„ depth.....	3-3.5	„
Posterior sucker (longitud.)	3.5	„
„ „ (transv.)	4	„

The species is quite distinct from *H. septemstriata*; indeed the only point of resemblance concerns the number of dorsal dark bands.

HIRUDO NOTABILIS, sp. nov.

Locality.—Ceres, Cape Colony.

Diagnosis.—Body distinctly flattened and very broad. (Killed condition.) Dorsal surface yellowish brown with seven very prominent dark bands extending along the whole length of the body. On either side of the median band in the middle and posterior region of the body is a discontinuous faint dark band which merges at intervals into inner side of the main band on its outer side.

Papillæ distinct in the preserved specimens, one in each outermost lateral band and one in each band on the inner side of this.

Ventral surface slate colour, the ventral surfaces of the anterior and posterior suckers much lighter.

Dorsal surface with a broad prominent yellow marginal band.

A large number of specimens of this species was kindly forwarded

to us by J. H. Hoffmeyr, Esq., Inspector of Schools. Below are given the average measurements of a number of these:—

Greatest length	30 mm.
„ breadth	7 „
„ depth	2 „
Posterior sucker (longitud.)	3 „
„ „ (transv.)	3·5 „

This species bears a close resemblance to *H. septemstriata*, and a comparison with Grube's figure might well on first examination justify its inclusion in that species. The resemblances concern measurements and pigment pattern of dorsal surface.

We quote Grube's diagnosis in part to explain the differences: "Ex olivaceo grisea, depressa, lavis, dorso vittis longitudinalibus fuscioribus 7 ornata, media ceteris, æque distantibus, latiore, a proximis paulo longius remota, externis marginem tangentibus, ventre concolore. . . . Discus posterior radiis albidis 5 ad 7 striatus. . . ."

Although in both forms there are seven (7) dorsal bands, and a faint linear pigmentation in the middle and posterior regions of the body between the median band and that on either side, yet not only are the lateral bands as important as the median in the species under consideration, but the intermediate bands are much larger than in *H. septemstriata*. Further, in our species there is no ornamentation on the dorsal surface of the posterior sucker; the ventral surface is a strong contrast in colour to that of the dorsal surface, whereas both are similar in *H. septemstriata*; and there is a strongly marked yellow margin to the dorsal surface as in other species noted in this paper, but of which no mention is made, and apparently correctly so, by Grube.

Both species agree in that the outermost dark band of the dorsal surface bears only a single sensory papilla.

HIRUDO INTERMEDIA, sp. nov.

Locality.—Smithfield, Orange River Colony.

We are indebted to the authorities of the South African Museum for a large number of specimens of this species.

Diagnosis.—Body elongate, flattened?

Dorsal surface yellowish-brown with series of dark pigment bands extending along the whole length of the body and consisting of a double band in the middle line, with three bands on either side of

this, of which the innermost two of each side may be double in nature and may be more important than the outermost.

A yellow marginal band at margin of dorsal surface.

The ventral surface has the same coloration as dorsal, and is provided with a marginal dark band where it meets the yellow band of the dorsal region.

All the specimens are poorly preserved internally, and judging from the extended condition they had evidently died some little time before being placed in preservative. This would account for the more or less cylindrical nature of the body, which, in the light of experience, was probably flattened as in the other species.

The dimensions of a number of specimens are given below :—

	1	2	3	4	5	6	7	8	
Greatest length	34	23	28	35	32	33	30	24	mm.
„ breadth	5	5	5	5	5.5	5.5	4.5	5	„
Length of posterior sucker ...	3	3	3	3.5	4	3.5	3.5	2	„
Breadth of posterior sucker ...	4	3	3	4	4	4	3	3	„
„ between genital pores	4	5	4	3.5	4.5	4	4	4	„

The species in regard to colour pattern might well be placed in Blanchard's species—*H. Hildebrandti*, but differences of a much more important nature prevent such. Unfortunately we are not in a position to make any note on the papillæ, as even if such were present, as they probably were, they cannot be seen in our specimens.

There is no trace of the groove on the under side of the anterior sucker as is figured by Blanchard in *H. Hildebrandti*.

Remarks.—It will be readily noted that the various species described, form together a more or less continuous series, which might be regarded as quite sufficient for justifying the inclusion of them all under one specific name, the differences being of no more importance than “local variations.” With this to a great extent we are in agreement, but, realising that later anatomical work may result in the removal of all the forms mentioned in this paper into a genus distinct from *Hirudo*, such a step is extremely inadvisable.

At the present day the various species of *Hirudo*, even in its amended and limited condition, are distinguishable almost solely on their colour pattern and the arrangement of papillæ. How far these distinctions agree with true specific differences awaits a settlement on anatomical and experimental lines. At the same time a discussion in such cases as to whether a species or variety is to be founded serves very little scientific purpose where invertebrates are concerned.

We have been particularly struck in examining these specimens with the special opportunities they offer for experiments on Mendelian lines, and no doubt much satisfactory information would be gained in that way.

All the species noted in this account are characterised by very small jaws provided with minute teeth which number about fifty. In this respect they stand in marked contrast to *Hirudo*, in which the jaws are very large and the teeth sharp. Furthermore, as in *Limnoddella*, there is no muscular dilatation between the epididymis and the base of the penis such as is found in *Hirudo medicinalis*.

It seems to us that it is advisable that all species should be described in such a way as to give information regarding the jaws, genital apertures, number of testes, and male reproductive ducts. Experience indicates that these should form the basis for a correct classification of the Hirudininae.

We hope to deal in greater anatomical details of the forms described in a later paper.

All the species noted possess seven dorsal black bands, which differ only in regard to the prominence of any particular one in a species.

All are characterised by a yellow marginal band except *H. septemstriata*, and the individuals examined in the case of the latter species did not show the faint additional bands in the posterior region of the body as figured by Grube. Yet as the bands other than the median were very difficult to make out the absence of such bands as mentioned may be only apparent.

H. Morrisii and *H. notabilis* agree in that the ventral and dorsal surfaces are quite different, and the latter species has the rudimentary pigment bands represented by Grube in his drawing of *H. septemstriata*. However, as the surfaces (dorsal and ventral) are similar according to Grube, and no mention is made of the very prominent marginal yellow band in *H. septemstriata*, there can be no confusion in this case. The resemblance lends special interest to these two forms, and if it has any significance at all bridges to some extent the gap between *H. septemstriata* and the other species, all of which bear the marginal yellow band.

H. intermedia closely approximates to *H. Hildebrandti* in that both surfaces are alike, both possess a yellow marginal band, and there is in each a dark marginal band on the ventral surface. The latter in every probability represents the dark ventral surface coloration of *H. Morrisii* and *H. notabilis*. *H. capensis* also possesses a dark ventral marginal band. It is thus seen that all

the species with the exception of *H. septemstriata* form a very complete series, and at the same time the latter species agrees with all except *H. capensis* in the possession of seven dorsal pigment bands, and in another detail, if Grube's account is accurate, approximates as a variation to *H. notabilis*.